50240

NPIC/TSSG/RED
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DEVELOPMENT OBJECTIVES
AUTOMATED FILM TRANSPORT STUDY

1. INTRODUCTION

These objectives describe the concept and requirements of a government sponsored study in automatic film loading, threading and transporting techniques as related to imagery exploitation equipment.

2. BACKGROUND

The history of rear projection viewers has shown film loading and transport systems to be a major source of complaint. Two major problems exist in most present systems: the first problem is that of loading and threading; the second is that of keeping the film flat while it is moved through the platen. These problems, among others, are factors that have caused the photo interpreters to shy away from general use of rear projection viewers.

Loading and threading on commercial variable width film viewers involves a series of operations. After the transport system has been rotated to the proper position and the switches set for loading the film spool, mounting brackets are adjusted to the proper width and the tension adjustment is also set for the proper width of film. Then the spool, conceivably weighting up to 30 pounds, is held in one hand as the keyed spindles are fit into the reel. An empty takeup reel is mounted in a similar manner on the opposite side of the platen. Film is then threaded through a series of rollers, through the platen and another series of rollers, to the takeup spool where it is hand wound until it is secured to the reel. After the switches have been reset, the viewer is ready for operation. The platens of the various viewers hold the film flat by either clamping the film in a glass sandwich (which precludes moving the film while viewing) or by pulling the film against a glass plate (which tends to scratch and tear the film as the film is transported over the edge of the plate). One attempt to build a rear projection viewer with a dynamic scanning capability utilized a thin fluid gate with the fluid acting as a lubricant. Unfortunately, the viewer required up to thirty minutes to thread.

Direct viewing light tables, which utilize motorized film transport techniques, sometimes experience vibrations induced by the film drive motors. In addition, the location of rollers causes the film to be either elevated slightly above the lighted surface or in direct contact with the surface. The former requires film hold-downs or other means of flattening the film when viewing; the latter can cause film damage when transporting the film.

SUBJECT: Development Objectives Automated Film Transport Study

The continuous roll printers used in photographic laboratories have a film path which takes the strands of negative and copy film and brings them in contact around the print drum and then takes the strands to their respective takeup rollers. The negative film cannot be readily transported independent of the copy film and must be rethreaded for slewing. This hinders selective frame printing and is a source of damage to the film.

Some present printing enlargers require that the film be removed to facilitate lens change. Since several magnifications (enlargement ratios) are often required for a single frame, the removal of the film becomes a major problem and film damage often results.

3. CONCEPT

3.1. Purpose - The purpose of this study is to build up a base of technology from which the Government can readily draw when designing new imagery exploitation systems containing roll film transports. The techniques involved, when employed in a film transport system, must reduce the time required to load and thread film, must permit single and double strands of various widths of film to be transported, must provide a wide range of transport speeds under smooth and positive control, must be compact and must not damage the film. In addition, a technique for maintaining a flat film image plane during film transport will be developed.

3.2. Scope - The scope of this study will be the investigation of the state-of-the-art of automatic film loading and self threading techniques, of film transport systems and of dynamic film support technology to determine what techniques are best suited for film viewing and printing equipment. The results of the investigation will be reported to the government periodically and a summary of all the research will be submitted at the end of the contract.

4. REQUIREMENTS

4.1. Technology Investigation - The contractor will investigate the following technologies for techniques which can be applied to film viewing and printing equipment transport systems.

4.1.1. Self Threading - The self threading systems used in motion picture cameras and projectors, microfilm readers, film processing equipment, magnetic tape transport systems, etc., will be investigated to determine what techniques can be utilized to thread unsprocketed film in a straight path, around bends, through platens and/or over viewing surfaces and onto takeup spools.

4.1.2. Automatic Loading - Designs for automatically adjusting the film spool holding spindles for various widths and diameters of spools will be investigated as well as designs for a "universal" takeup reel which would be adjustable to the various lengths and widths of film used, i.e., lengths of 250', 500' and 1000' and widths of 70mm, 5", 6.6" and 9½".

4.1.3. Film Transporting - Various techniques of transporting film will be investigated including capstan and reel drives, A.C., D.C. and hydraulic drive motors, tachometer and spool diameter sensor feedback controls, looping mechanisms, and combinations of these or other drive and control systems.

4.1.4. Film Flattening - Methods of keeping film flat while it is transported across a platen will be investigated. Included in the study will be such techniques as edge guides, air suspension, fluid suspension and electrostatic suspension. Methods of flattening film in the static mode over a platen or viewing surface will also be investigated.

4.2. Data Screening - The contractor will review the results of the technology investigation to determine which techniques can be applied to film viewing and which to printing systems. The following parameters will be considered in evaluating the techniques.

4.2.1. Viewers - Viewing systems may use one strand of film or two in widths of 70mm to 9½". The film thickness is generally 4 mil. Viewers require a range of film transport speeds of from about .4"/min. to about 60'/min for scanning and about 300'/min for slewing. In addition, the film motion must be smooth at all speeds. The film crossing the platen area must be held flat within the tolerances of the depth of field over the field of view of the projection system. For example a rear projection viewer with 48X magnification f/18 lens and a 30" X 30" screen would require the film to be held flat within ± .012" over a .625" X .625" area. The size of the transport system should be no greater than present systems (about 30" X 30" for rear projection variable width film viewers). Loading should require only a single access to the transport system.

4.2.2. Light Tables - Light tables may use one or two strands of film in widths of 70mm to 9½". The transport speeds range from about 2"/min to 150'/min for scanning and 300'/min for slewing. The film motion must be smooth at all speeds and the system cannot damage the film. A method for holding the static film flat and stationary for detailed microscope viewing, for indexing, for measuring or for tracing should be included. The hold down system must be quiet, fast and simple to engage or disengage. In the dynamic scanning mode the film must be relatively flat and close to the lighted surface.

SUBJECT: Development Objectives Automated Film Transport Study

4.2.3. Contact Printers - Contact printers require a transport system for both the negative and copy film which will maintain a constant speed (100'/min on the Niagara Printer) with the films in contact over the exposure station. In addition, the transport system for the negative should be capable of slewing the negative film at up to 300'/min without damage and independent of the copy film. Printers must handle film widths of from 70mm to $9\frac{1}{2}$", lengths up to 1000' and thickness ranging from 1.5 mil to 5 mil without damage.

4.2.4. Enlarging Printers - Enlarging printers require a single transport system for widths of negative film of from 70mm to $9\frac{1}{2}$", lengths up to 1000' and thicknesses of from 1.5 mil to 5 mil. The film transport speed control should provide a range of speeds which will allow fine positioning of the film in the platen and a slew speed of 300'/min. The transport system should not damage the film in any mode of operation.

4.3. Applied Research - The contractor will perform research and breadboarding when necessary to apply existing technology to variable width photographic film transport systems. This research will be restricted to automatic loading and threading techniques, film drive and control techniques, and dynamic and static film support techniques. (Any specific research project requiring more than two man weeks of investigation will have to be cleared with the technical monitor before it is undertaken).

5. MISCELLANEOUS

5.1. Reporting - The contractor will be required to provide monthly reports and a final report. The monthly report will follow the DB-1001 specification attached. The final report will be submitted within 30 days of the completion of the investigation. It will summarize the progress of the study and tabulate the results of the investigation. The final report must be completed within the allowable cost of the contract.

5.2. Consultations - The contractor will be on call to respond to specific requests for information, or advice within the study area during the contract period. The contractor may also be called upon to give an oral presentation of the work performed and results found.

5.3. Proposal Format - The submitted proposal will conform to the attached Guide for Proposal Format.

5.4. This will be a 1 year level of effort.